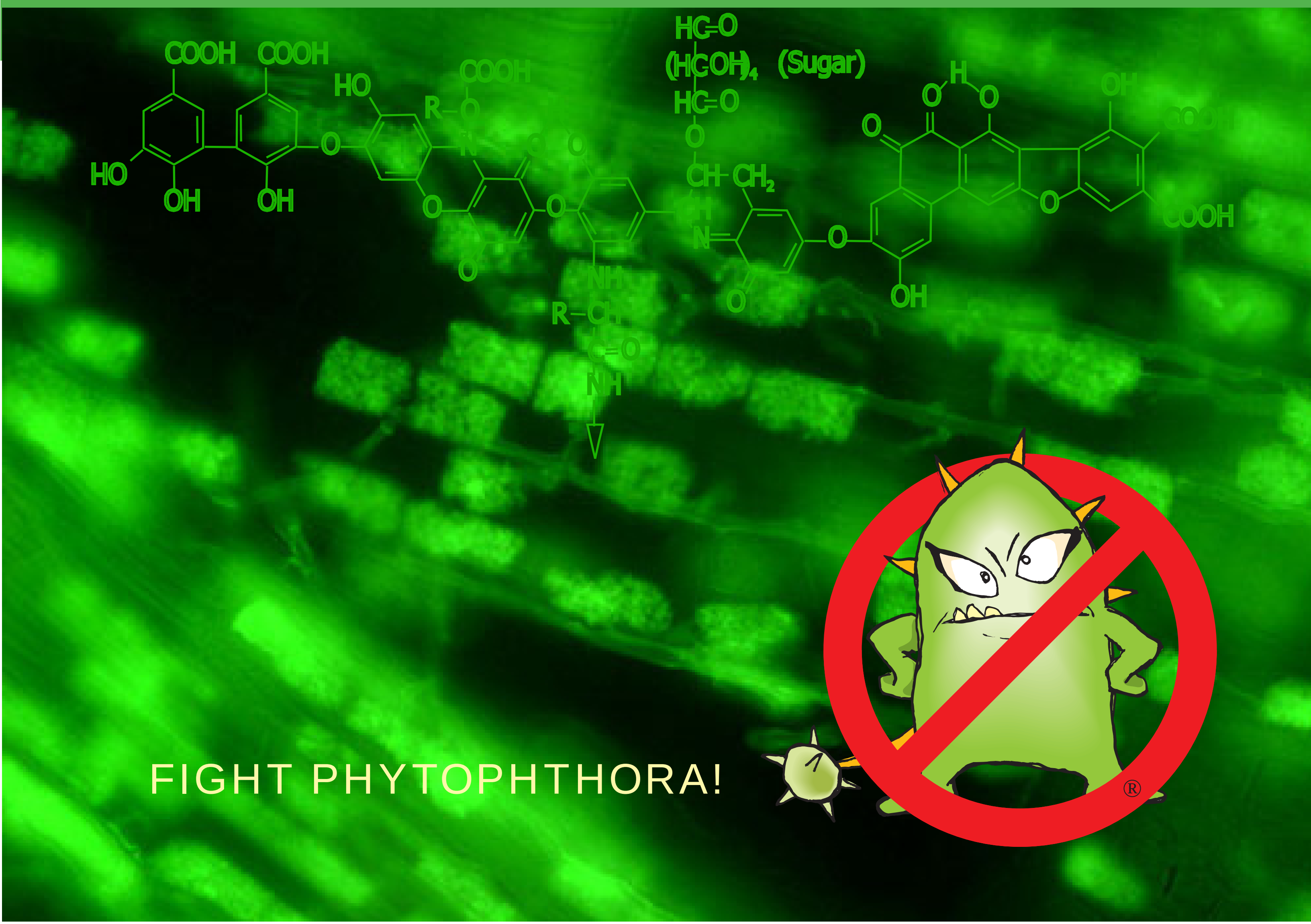
Organic Fundamentals

Technical Series

PERFECT BLEND ORGANICS®

Mycorrhizal and Phytophthora Abstracts



Fight Opportunistic Phytophthora Root Disease with Perfect Blend's Exclusive

Phyto-Fighter Formulations!

Perfect Blend fertilizers with Phytophthora fighting increased concentrations of mycorrhizal fungus spores are designed to provide maximum Phytophthora fighting concentrations of mycorrhizae colonies.

High mycorrhizae formulations are now available for use in fighting Phytophthora diseased root systems. Scientifically formulated Perfect Blend with mycorrhizae provides a two way-program for defeating Phytophthora attack. Phytophthora frequently attacks plants, trees, and turf that have poor nutrition or have suffered under repeated applications of synthetic fertilizers which weaken or destroy the soil micro-organisms that normally protect trees from root rot diseases. Perfect Blend mycorrhizae inoculated fertilizers provide the complete nutrition that enables the formation of complex fulvic and humic acids that are the most efficient foods for soil micro-organisms. Fortified with these nutrients, and inoculated with beneficial mycorrhizae spores, a plant can quickly rebuild a Phytophthora defense system that has been weakened or destroyed by previous synthetic fertilizer applications. Over phosphorus application will destroy the beneficial mycorrhizal colonies that actually protect tree roots by at least two important mechanisms. These mechanisms include the physical shielding of the tree roots by the beneficial mycorrhizal fungus and also the production of antibiotics that can kill the attacking Phytophthora fungus.

Can other fertilizers protect your trees from Phytophthora? Don't bet on it. Only Perfect Blend has a high technology formulation that provides the slow release transfer of nutrients that are critical to the health and growth of the beneficial mycorrhizal contained within the formulation.

Perfect Blend with mycorrhizal should be injected or poured into the root zone or worked into the soil for to provide long term protection. The secret of the Perfect Blend formulations is that not only does Perfect Blend include mycorrhizae spores it is formulated to provide growing and expanding mycorrhizal colonies with the food necessary for the fungus to become established and spread. Simply putting mycorrhizae into the soil alone is not as effective as putting mycorrhizae into the soil along with a long term slow release organic food source.

We invite you to try the new high mycorrhizae formulations. Ask your distributor for either the 100% organic 4-4-4 or 7-2-2 with enhanced Phytophthora grade mycorrhizae next time you aerate your soils. After aeration apply at the rate of approximately 1 ton per acre for maximum Phytophthora fighting effectiveness. Its called an **Phyto-Fighter** – ask for it.

Where's the science?

At Perfect Blend we believe you can evaluate science abstracts just as well as we can. Here are the cites for your review. Want more? Just ask. We have dozens.

Bio-control of Phytophthora root pathogens by AMF: a study of possible mechanisms

NORMAN, JAMES1, CLARA VIGO1, JILL POVEY1, NEIL GOW2 , MIKE MORRIS2, KYRSTEN BLACK1 & JOHN HOOKER1. 1 Soil Biology Unit, Land Resources Department, SAC, Craibstone Estate, Aberdeen AB22 9TQ, UK. 2Department of Molecular and Cell Biology, University of Aberdeen,Marischal College, Aberdeen AB9 IAS, UK.

There are many reports in the literature of interactions between arbuscular mycorrhizal fungi (AMF) and Phytophthora root pathogens. Effective management of the symbiont-pathogen interaction requires an understanding of the mechanisms involved in order to ensure a consistent response. Interactions between Lycopersicon esculentum, Fragariae x ananassa Duchesne and Phytophthora were investigated and up to 60 % disease control was measured in roots of AMF colonised plants. Further studies aimed to identify the mechanisms involved and measured the impact of AMF on root architecture, sporangia formation, zoospore taxis and root tip electrical fields.

1994 Contribution of arbuscular mycorrhizal to biological protection of micropropagated pineapple nananas-comosus (L) Merr against phytophthora cinnamomi rands, agricultural science in Finland 3:241-251ENCE IN FINLAND 3:241- 251.

Phytophthora cinnamomi Rands causes root rot of pineapple (Ananas comosus (L.) Men.) and the development of this disease is harmftfl for fruit production. Micropropagated plants of two varieties, Queen Tahiti and Smooth Cayenne (clone CYO), were inoculated at transplanting from axenic conditions with an arbuscular mycorhizal thngus to evaluate the importance of endomycorrhiza development for biological protection against P. cinnamomi. Growth and mineral nutrition of endomycorrhizal plants were not affected by different inoculum levels of P. cinnamomi, whilst they were reduced for nonmycorrhizal plants. Root/shoot ratio of endomycorrhizal plants was lower than that of non-mycorrhizal plants, and the pathogen did not modify this effect except at highest inoculum levels of P. cinnamomi. Endomycorrhizal colonization was not altered by the pathogen; however symbiotic functioning was reduced by the highest concentration of inoculum of P. cinnamomi. Endomycorrhization is an interesting biotechnology for the production of micropropagated pineapple. Resistance mechanisms to Phytophthora nicotianae var. parasitica in mycorrhizal tomato: pathogen development within root tissues and host cell responses

Localized versus systemic effect of arbuscular mycorrhizal fungus on defense responses to Phytophthora infection in tomato plants.

J EXP BOT. 53(368):525-534. Pozo MJ, Cordier C, Dumas-Gaudot E, et al. 2002. Address: Pozo MJ, Texas A&M Univ, Dept Plant Pathol & Microbiol, College Sm, TX 77843

Development of biological control for plant diseases is accepted as a durable and environmentally friendly alternative for agrochemicals. Arbuscular mycorrhizal fungi (AMF), which form symbiotic associations with root systems of most agricultural, horticultural and hardwood crop species, have been suggested as widespread potential bioprotective agents.

In the present study the ability of two AMF (Glomus mosseae and Glomus intraradices) to induce local or systemic resistance to Phytophthora parasitica in tomato roots have been compared using a split root experimental system. Glomus mosseae was effective in reducing disease symptoms produced by P. parasitica infection, and evidence points to a combination of local and systemic mechanisms being responsible for this bioprotector effect. Studies on the lytic activity against Phytophthora cell wall of root protein extracts also corroborated a systemic effect of mycorrhizal symbiosis on tomato resistance to Phytophthora.

Interaction between Glomus deserticola and Phytophthora cactorum on the growth of two apple rootstocks.

SAINZ. MARIA J.1, ANTON VILARIRO2, JULIAN GARCiABERRIOS1, CRISTINA PINTOS3 & S. PEDRO MANSILLA1,3. iDepartamento de Producción Vegetal, Universidad de Santiago de Compostela, E-27002 Lugo, SPAIN. 2Instituto de Investigaciones Agrobiológicas de Galicia (C.S.I.C.), Apdo. 122, E-15080 Santiago de Compostela, SPAIN. 3Estación Fitopatolégica de Arceiro, Excma. Diputaciôn Provincial de Pontevedra, E-36153 Pontevedra, SPAIN.

An experiment was designed to study the interaction between Glomus deserticola and Fhytophtoraa cactorum on the growth of M.9 and 106 apple rootstocks, which have been obtained from in vitro culture. For both rootstocks, the following treatments were established: control, inoculation with Glomus deserticola, inoculation with Fhytophthora cactorum, inoculation with Glomus deserticola + Fhytophthora cactorum. For every treatment, four plastic bags containing 1.5 1 of a sand:vermiculite (1:1) mixture were planted with the corresponding rootstock and randomly arranged in a growth chamber under controlled environmental conditions. Five months after planting, plants were harvested and plant height, root length, dry weight of leaves and green stems, number of stem nods, shoot P concentration and AM root colonization were determined.

Also the stem diameter was measured 2 or 5 cm above soil level (depending on the plant development). Inoculation of both apple rootstocks with Glomus deserticola resulted in increased stem length, number of stem nods, shoot dry weight and shoot P concentration whether or not the plant had been also inoculated with Phytophthora cactorurn.

Arbuscular mycorrhizae are known to decrease root damage caused by fungal pathogens

CORDIER CHRISTELLE, VIVIENNE GIANINAZZI-PEARSON & SILVIO GIANINAZZI Laboratoire de Phytoparasitologie, INRAICNRS, SGAP, INR&, BV 1540, 21034 Dijon cédex, France

Arbuscular mycorrhiza are known to decrease root damage caused by fungal pathogens, but the mechanisms involved are not well understood. Our research is aimed at analyzing interactions between Glomus mosseae and the pathogen Phytophthora nicotianae var. parasitica in roots of tomato (Lycopersicon esculentum) at tissue and cellular levels, in order to better understand the bioprotective effects of arbuscular mycorrhiza. In pathogen-infected mycorrhizal root systems, hyphae of G. mosseae and P. n. v. parasitica are, in most cases, found in different root regions but they can also develop in the same root tissues. Quantification of P. n. v. parasitica hyphae in root tissues showed that pathogen spread was greatly reduced in both mycorrhizal and nonmycorrhizal portions of mycorrhizal root systems. P. n. v. parasitica never invaded arbuscule-containing cells in mycorrhizal tissues. Moreover, arbuscule-containing cells surrounded by intercellular P. n. v. parasitica hyphae did not necrose and only a weak autofluorescence was associated with the host cells. These observations suggest that bioprotection by G. mosseae against P. n. v. parasitica may be due both to direct interactions between the fungi in the same root tissue as well as long-distance effects of mycorrhizal development on pathogen infecton.

Impact of chemical, biological and cultural treatments on the growth and yield of apple in replant-disease soil.

Utkhede RS; Smith EM. 2000. AUSTRALASIAN PLANT PATHOLOGY. 29(2):129-136. Address: Utkhede RS, Agr & Agri Food Canada, Pacific Agri Food Res Ctr, PUB 1000, Agassiz, BC VOM IAO, Canada.

An orchard experiment was established to determine the long-term (six year) effects of chemical (sodium methyldithiocarbonate-metam sodium), fertiliser (monoammonium phosphate) and biological agents [strain B8 of Enterobacter agglomerans, strain EBW-4 of Bacillus subtilis and Glomus intraradices (GI)] alone and in selected combinations on tree growth, fruit production and root rot incidence of apple trees in apple-replant-disease soil that was conducive to replant disease over six years. The response was measured by increases in trunk cross-sectional area, fruit yield and percent root rot of Gala apple trees on M.9 rootstock. The application of E. agglomerans (B8), B. subtilis (EBW-4), G. intraradices (GI), metam sodium (MS), MS + B8, MS + CI and B8 + EBW4 significantly increased fruit yield, tree trunk growth and reduced infection by Phytophthora cactorum and Pythium ultimum. These results suggest the potential use of E. aerogenes (B8), B, subtilis (EBW-4) and G. intraradices to increase growth and fruit production of apple trees planted in soil conducive to replant disease.

Cellular and molecular events underlying the induction of resistance against Phytophthora parasitica in mycorrhizal tomato plants.

CORIMER, CHRISTELLE1, NURIA FERROL1, JOSE-MIGUEL BAREA1, SILVIO GIANINAZZI2 & VIVIENNEGIANINAZZIPEARSON2. IEstación Experimental del ZaidIn, CSIC, 18008 Granada, SPAIN. 2Laboratoire de Phytoparasitologie INRA/CNRS, CMSE-INRA, BV 1540,2 1034 Dijon cédex, FRANCE.

The ability of arbuscular mycorrhiza to decrease root disease caused by soil borne pathogens is well recognized, but very little is known about the mechanisms that are really active. We have analysed interactions between Glomus rnosseae and Phytophthora parasitica in roots of Lycopersicuin esculentum in order to elucidate tissue, cellular and molecular phenomena underlying bioprotection. Using a split root experimental system, we have shown that the control of P. parasitica in mycorrhizal tomato root systems involves induction of a localized resistance in arbuscule-containing cells and a systemic resistance in non mycorrhizal tissues.Ultrastructural investigations coupled with histochemical and immunocytochemical analyses have provided evidence that decreased pathogen development in both mycorrhizal and non mycorrhizal parts of mycorrhizal root systems is associated with the elicitation of host wall modifications, together with the accumulation of defence-related molecules. Present investigations are aimed at characterizing plant genes expressed during bioprotection of mycorrhizal tomato challenged with P. parasitica.
Key words: biocontrol - induced resistance -cytomolecular analyses - wall modifications - defence molecules.

Biological control of chestnut ink disease with ectomycorrhizal fungi

BRANZANTI, M. BARBARA 1, ELISABETTA ROCCA2 & ANNAMARIA P1513. 1 Dipartimento di Biotecnologie Agrarie ed Ambientali, V. Brecce Bianche, Ancona 60131, ITALY. 2 Dipartimento di Protezionc c Valorizzazionc AgroAlimentare, V. Filippo Re 8, 20126 Bologna, ITALY. 3 Istituto di Patologia Vegetale V. Filippo Re 8, 20126 Bologna, ITALY.

Studies have shown that the ectomycorrhizal (ECM) fungi Laccaria laccata (Scop. Ex Fr.) Bk., Hebeloma crustuliniforme (Bull. cx Fr.) QuE1, Hebeloma sinapizans (Paulet ex Fr.) and Faxillus involutus (Batsch) Fr. which are capable of forming ectomycorrhizae with chestnut in greenhouse experiments exhibit antagonistic capacity against Phytophthora cambivora (Petri) Buism. in paired cultures on agar plates. The aim of the present study was to investigate if an early infection by mycorrhizal fungi might protect Castanea sativa Mill.seedlings against attacks of ink disease. At the end of the first vegetative season mycorrhizal and non-mycorrhizal seedling were challenged with a zoospore suspension off. cambivora. The interactions of the ECM fungi and the pathogenic fungus were studied using the light microscope and the scanning electron microscope. All the fungi tested had a protective effect against ink disease. In mycorrhizal plants no sign of infection of F. cambivora was observed; rare zoospores not germinated were present in non-mycorrhizal segments only.

Norman JR; Hooker JE. 2000.

Sporulation of Phytophthora fragariae shows greater stimulation by exudates of non-mycorrhizal than by mycorrhizal strawberry roots.

MYCOLOGICAL RESEARCH. 104:1069-1073. Address: Hooker JE, Univ Glamorgan, Sch Appi Sci, Pontypridd CF37 1DL, M Glam, Wales.

Arbuscular mycorrhizal fungi (AMF) show significant potential for biocontrol of Phytophthora spp., but there is little evidence for the mechanisms involved in the process. This study establishes that microorganism free exudates from roots colonised by AMF result in significantly less sporulation of P. fragariae than those from uncolonised plants. Experimentsin vitro showed that after 48 h in the presence of exudates from strawberry roots colonised by Glomus etunicatum and G. monosporum, sporulation of P. fragariae was reduced by ca 67% and 64% relative to sporulation in the presence of uncolonised roots. After 72 h sporulation was reduced by 83% and 89% respectively. These data were then confirmed in an in vivo system in which Phytophthora fragariae was inoculated into the mycorrhizosphere of either uncolonised strawberry plants or those colonised by G. etunicatum. A similar h end was observed, with a 69% reduction in sporulation of P. fragariae after 72 h in the mycorrhizosphere of colonised plants relative to sporulation in the mycorrhizosphere of uncolonised plants.